{In Archive} Air Permit Application for Garden State Offshore Energy
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1 Attachment

Final GSOE SeaZephIRTM Spar Buoy application.pdf

Steve/Viorica,

Attached please find an electronic copy GSOE's permit application to install and operate a buoy based light detection and ranging (LIDAR) system off the coast of Southern New Jersey. As you know, a Notice of Intent (NOI) for the project was submitted on September 14, 2010.

Since the submittal of the NOI, project design and emission estimates have been refined. These minor changes are reflected in the attached air permit application. Potential emissions from the proposed project are below applicable PSD and NNSR major source thresholds.

A hardcopy will follow via FedEx for Monday delivery.

If you have any questions regarding this letter or need any further information, please do not hesitate to contact Aileen Kenney, Director of Permitting for Deepwater Wind, LLC at (401) 648-0607 or me at (201) 508-6945.

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Garden State Offshore Energy SeaZephIR™ Spar Buoy Meteorological Station Project Air Permit Application

Prepared for:

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October 1, 2010

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1.0 INTRODUCTION

Section 328(a)(a) of the Clean Air Act (CAA or Act) requires EPA to establish requirements to control air pollution from outer continental shelf (OCS) sources in order to attain and maintain federal and state ambient air quality standards and to comply with the provisions of part C of Title I of the Act. In accordance with 40 CFR Part 55.2, an OCS source means "any equipment, activity, or facility which (1) emits or has the potential to emit any air pollutant; (2) is regulated or authorized under the Outer Continental Shelf Lands Act; and (3) is located on the OCS or in or on water above the OCS". Depending upon the location of an OCS source, different requirements apply. For OCS sources located within 25 miles of a states' seaward boundary, federal, state and local requirements of the corresponding onshore area (COA)[1] apply.

Prior to submitting a preconstruction permit application, the OCS source must submit a Notice of Intent (NOI) to the Regional Administrator, with copies to the air pollution control agencies of the nearest onshore area. A copy of the NOI is included in Appendix A.

1.1 Project Overview

To help achieve the goals set forth in New Jersey's Energy Master Plan, Garden State Offshore Energy LLC (GSOE), a joint venture of PSEG Renewable Generation, LLC and Deepwater Wind New Jersey, LLC, plans to build a wind farm off the coast of Southern New Jersey. Prior to construction of the proposed wind farm, it is essential to collect and analyze site-specific data to support the engineering and designing the wind farm, as well as the financing of the wind farm. As such, GSOE is proposing to construct and operate a spar buoy equipped with a light detection and ranging (LIDAR) monitoring station, approximately 20 miles off the coast of Southern New Jersey.

The proposed meteorological station, known as the Sea ZephIR™ (SZ), is a spar buoy equipped with a Zephir LIDAR unit. The spar buoy design is an inherently stable platform used worldwide in marine operations. A Zephir LIDAR unit is mounted and secured to the top of the buoy. Ancillary power supplies and telemetry subsystems are housed in the body of the buoy. Once deployed at site, the LIDAR will provide wind measurement data that can be accessed via a radio link. The buoy is moored using a "clump weight" anchor. The water depth at which the mooring system will be deployed is approximately 80 feet.

The SZ floating spar buoy platform is approximately 100 feet in length and six feet in diameter. The superstructure of the SZ is designed for deployment in harsh marine conditions while

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[1] Corresponding onshore area means the onshore area that is geographically closest to the source or another onshore area that the Administrator designates as the COA pursuant to 50 CFR Part 55.5.

offering maximum stability through the use of an on-board ballasting mechanism that will reach approximately 60 feet below the ocean surface. The buoy is moored to the ocean floor via a single clump weight anchor. A main mooring line, safety line and yaw stabilizer line will be connected to the clump weight anchor and to the base of the buoy. Approximately 30 – 40 feet of the SZ will be above the ocean surface and will house the LIDAR equipment, power sources (battery and wind micro-turbines), and passive acoustic monitoring systems.

The data gathered by the SZ contributes to GSOE's meteorological assessment campaign by serving three purposes: (1) it informs on the optimum location for the wind farm, (2) it informs the selection of the turbines by defining the wind shear and turbulence characteristics and (3) it results in the creation of an energy production report which will be used for the ultimate financing of the wind farm project.

The SZ will consist of three phases: installation, operation, and decommissioning.

<u>Installation</u>

The concrete clump weight mooring will be fabricated at a local New Jersey marine yard. Upon completion, the clump weight mooring will be pre-set at the site via a 4-point crane barge supported by an anchor handling tug. The spar buoy will be towed to the site and then will be ballasted to the vertical plane and connected to the mooring. Installation is expected to occur over a period of approximately 2 days. A list of equipment that will be utilized during installation of the spar buoy is presented in Table 1-1. The 12 diesel and gasoline powered engines associated with this equipment have power ratings ranging from 9 to 800 horsepower (hp) with no add-on air pollution control equipment.

<u>Operation</u>

There will be no emissions associated with the operation of the SZ. Power to operate the instruments on the SZ will be provided by batteries, solar power, and wind micro-turbines. During the operational period, GSOE will use a crew boat to service and maintain the station as needed, with a typical schedule of one trip per month. The operational period is expected to start in December 2010 and last for 24 months.

<u>Decommissioning and Removal</u>

Once the requisite met data has been collected the spar buoy will be decommissioned from the site. During decommissioning, the installation process is basically reversed. Estimated emissions during the decommission/removal of the SZ are assumed to be equal to the emissions during installation.

1.2 Application Summary

The Sea ZephIR™ is a minor stationary source, and as such is not subject to Prevention of Significant Deterioration (PSD) or non-attainment new source review (NSR) requirements. The existing air quality for the project site is established based on conditions in the two nearest counties in New Jersey: Ocean and Atlantic counties. Ocean and Atlantic counties are designated as attainment or unclassifiable for sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), particulate matter less than 10 microns (PM-10) and particulate matter less than 2.5 microns (PM-2.5). Both counties are designated as moderate non-attainment for ozone. Therefore, facilities with annual emissions greater than 25 tons of nitrogen oxides (NO_x) or 25 tons of volatile organic compounds (VOC), which are precursors of ozone, are subject to NNSR.

Because the proposed project is considered a new facility and is not one of the 28 source categories identified in the PSD regulations, the proposed project would need to have potential emissions of a regulated pollutant greater than 250 tons per year to be a major source subject to PSD review. Because potential annual emissions are less than the 250 ton/yr major source threshold for all pollutants, the project is not subject to PSD requirements. Further, since potential emissions of NO_x and VOC are less than the Non-Attainment NSR major source threshold of 25 tons per year (tons/year) for NO_x and for VOC, the project is not subject to Non-Attainment NSR requirements such as Lowest Achievable Emission Rate (LAER) and emissions offsets. In addition, NO_x or VOC emission offsets are not required due to the non-applicability of Non-Attainment NSR requirements. A summary of the Project's potential to emit is presented in Table 1-2.

The diesel engines are not subject to New Jersey Department of Environmental Protection (NJDEP) State of the Art (SOTA) requirements because the potential to emit for each criteria pollutant and HAP is less than the thresholds listed in Tables A and B of Appendix 1 of Subchapter 8. This application demonstrates that the Project will be in compliance with all other applicable federal and state air quality requirements, including the following:

- Subchapter 3 "Control and Prohibition of Smoke from Combustion of Fuel" Opacity limitations;
- Subchapter 4 "Control and Prohibition of Particles from Combustion of Fuel" Total Particulate Matter (PM) / Particulate Matter less than 10 microns in diameter (PM-10) limitations; and
- Subchapter 9 "Sulfur in Fuels" Fuel Oil Sulfur Content and Sulfur Dioxide (SO_2) limitations.

An air quality impact dispersion modeling analysis is not required to be performed for the project based upon the NJDEP Bureau of Air Quality Evaluation's Technical Manual 1002 –

Guidance on Preparing an Air Quality Modeling Protocol that lists criteria pollutant potential emission thresholds that trigger an air quality impact analysis. The applicable emission thresholds are not exceeded by the project.

1.3 Supporting Data

A copy of the NOI is included in Appendix A and emission calculations are provided in Appendix B.

Table 1-1: GSOE Construction & Decommissioning Equipment List

Equipment Make/Model	Function
Caterpillar 3412	Tug main engine - marine propulsion
Kubota SR613X	Tug generator - electrical power
Yanmar HT210A	Portable barge generator - electrical power
Detroit Diesel 471	Deck engine for winch - mechanical power
Detroit Diesel 471	Deck engine for winch - mechanical power
Deutz TCD 2013	Welding arc power - portable engine
Cummins 9310	Crane engine - mechanical power
Yanmar 903	Diver's air supply - portable engine
Lister 3475	Diver's air supply - portable engine
John Deere PR2-8	Air tools - portable engine
Briggs & Stratton 1550	Water pump system - portable engine
Honda 4 stroke	Outboard motor - marine propulsion

Table 1-2: GSOE Potential to Emit Summary

Pollutant	Emissions (tons/year)			
	Installation	Operation	Decommission	Total[a]
NO_x	1.35	2.98	1.345	4.33
CO	0.33	0.77	0.334	1.11
VOC	0.19	0.52	0.192	0.71
SO_2	0.0014	0.01	0.0014	0.012
PM	0.09	0.20	0.093	0.293
PM-10	0.09	0.20	0.093	0.293
PM-2.5	0.09	0.20	0.093	0.293

a) Since the construction and decommission phases will not occur within the same year, total annual emissions are the sum of emissions during construction OR decommission and emissions during operation.

2.0 PROJECT DESCRIPTION

2.1 Project Conceptual Design

GSOE is proposing to install and operate a Sea ZephIR™(SZ), a buoy-based LIDAR system approximately 20 miles off the shore of Southern New Jersey (between Atlantic and Ocean counties). A site location map is provided in Figure 2-1. As shown in Figure 2-1, all activities will occur in federal OCS waters. The SZ will be anchored with a clump weight anchor in a depth of about 80 feet and will be located at or near the following location:

BOEM Block 7033 39° 04.42’ N, 74° 18.32’ W

The project will consist of three phases: installation, operation, and decommissioning.

<u>Installation</u>

Installation of the Sea ZephIR™ will occur in two stages: during Phase 1 the clump weight anchor will be placed on the sea bed as a pre-set anchor; during Phase 2 the spar buoy will be connected by mooring chain to the pre-set, clump weight anchor. A list of equipment that will be utilized during installation of the spar buoy is presented in Table 1-1. The 12 diesel and gasoline powered engines associated with this equipment have power ratings ranging from 9 to 800 horsepower (hp). These engines will run between 10 and 128 hours during the installation process, depending on the role of the equipment in the installation. No add-on air pollution control equipment is proposed for the installation equipment. Estimated emissions during installation of the SZ are summarized in Tables B-1 through B-3 in Appendix B. Appendix B also contains estimates on the types and amounts of fuel used in the equipment.

The specific activities of the two installation phases are described below.

Phase 1 – Clump Weight Anchor Installation

The concrete clump weight anchor will be fabricated at a local New Jersey marine yard. Once fabricated, the anchor will be loaded onto a work barge and sea fastened to the barge deck. There is no propulsion engine on the work barge. The work barge will be towed by a tug equipped with a Caterpillar 3412 engine (or similar).

The tow from the marine yard to the deployment site is anticipated to take a maximum of 20 hours. Electricity is required for tug lights and other ancillary equipment; the tug generator will provide the electricity. The tug generator engine will be a Kubota SR613X, or similar. The tug generator is anticipated to operate for 64 hours total during the Phase 1 deployment.

Once at the deployment site the barge will be anchored, the anchors will be lowered and raised using deck engines which are Detroit Diesel 471, or similar. The deck engines will be active for a maximum of 15 hours each (two engines) during Phase 1 of installation. Once the anchors are set the work barge becomes an OCS source.

During the 24-hour period when the work barge is anchored to the OCS there is no propulsion source (no engine holding it in place).

The clump weight will then be lowered to the sea floor using one of the deck engine winches with a Detroit Diesel 471, or similar, engine for 1-hour.

If welding is necessary to repair or maintain equipment then a portable arc welding system will be activated (Deutz TCD 2013 engine, or similar) for an estimated maximum of 6 hours during Phase 1 of installation.

Currently, there is no plan to have a crane engine on the work barge during Phase 1 of installation.

If diver intervention is required during the Phase 1 deployment, then the diver air supply will be activated (Yanmar 903, or similar) for an estimated maximum period of 10 hours. As is always the case for health and safety, a backup diver air supply (Lister 3475, or similar) will also run for an estimated maximum 10 hour period during Phase 1 of installation.

Certain tools aboard the barge require electrical power, which will be supplied by the portable barge generator (Yanmar HT201A or similar engine). The portable barge generator is anticipated to run for 38 hours (19 hours during tow and 19 hours while anchored) during Phase 1 of installation.

The work barge is equipped with pneumatic hand tools such as wrenches, screwdrivers, etc. If these tools are used they will require an air supply which will be provided by a compressor run by a John Deere PR2-8, or similar. It is anticipated that there will be a maximum of 7.5 hours of tool use during Phase 1 of installation.

The work barge anchors will be recovered using the deck engines which are Detroit Diesel 471, or similar. The time associated with raising the anchors is factored into the 15 hour estimate above. The work barge will then be towed for approximately 20 hours back to the port by the tug (Caterpillar 3412 or similar).

See Table B-1 in Appendix B for a breakdown of OCS source versus non-OCS source time.

Phase 2 – Spar Buoy Installation

Installation of the spar buoy will follow the same general process as Phase 1 of installation.

The spar buoy and work barge will be towed by the tug (Caterpillar 3412 or similar) to the deployment site. The tow from the port to the deployment site is anticipated to take a maximum of 20 hours. Electricity is required for tug lights and other ancillary equipment; the tug generator will provide the electricity. The tug generator engine will be a Kubota SR613X, or similar. The tug generator is anticipated to operate for 64 hours total during Phase 2 of installation.

Once at the deployment site the work barge anchors will be lowered and raised using the deck engines which are Detroit Diesel 471, or similar. The deck engines will be active for a maximum of 15 hours each (two engines) during Phase 2 deployment. Once the anchors are set the work barge becomes an OCS source.

During the 24-hour period when the work barge is anchored to the OCS there is no propulsion source (no engine holding it in place).

Once the barge is fast to its mooring, the spar buoy will be maneuvered alongside the barge and the water pump system (Briggs & Stratton 1550, or similar) will be used for a maximum of 18 hours to fill a system of ballast tanks on the buoy with seawater. The ballast operation will re-align the buoy from the horizontal plane to a vertical position. Once vertical, the buoy will be held on station at the anchored barge while a dive team attaches the mooring chain to the clump weight anchor. The divers air supply will be activated (Yanmar 903, or similar) for an estimated maximum period of 10 hours. As is always the case for health and safety, a backup divers air supply (Lister 3475, or similar) will also run for an estimated maximum 10 hour period during Phase 2 of installation.

If required for lifting, a crane (Cummins 9310 or similar) will be utilized for a maximum of 10 hours during Phase 2 of installation.

Certain tools aboard the barge require electrical power, this will be supplied by the portable barge generator (Yanmar HT201A or similar engine). The portable barge generator is anticipated to run for a maximum 38 hours (19 hours during tow and 19 hours while anchored) during Phase 2 of installation.

The work barge is equipped with pneumatic hand tools such as wrenches, screwdrivers, etc. If these tools are used they will require an air supply which will be provided by a compressor run by a John Deere PR2-8, or similar. It is anticipated that there will be a maximum of 7.5 hours of tool use during Phase 2 of installation.

If welding is necessary to repair or maintain equipment then a portable arc welding system will be activated (Deutz TCD 2013 engine, or similar) for an estimated maximum of 6 hours during Phase 2 of installation.

During buoy deployment it may be necessary to launch a work skiff from the barge for ancillary tasks (Honda 4 stroke or similar). It is anticipated that the work skiff would be active for a maximum of 24 hours.

The work barge anchors will be recovered using the deck engines which are Detroit Diesel 471, or similar. The time associated with raising the anchors is factored into the 15 hour estimate above. The work barge will then be towed for approximately 20 hours back to the port by the tug (Caterpillar 3412 or similar).

See Table B-1 in Appendix B for a summary of the estimated OCS source emissions.

Operations & Maintenance

There will be no emissions associated with the operation of the SZ. Power to operate the instruments on the SZ will be provided by batteries, solar panels and wind microturbines.

During the operational period, GSOE will use a crew boat (Caterpillar 3408 engine or similar) and a Rigid Inflatable Boat (RIB) (Suzuki Outboard DF115 or similar) to service and maintain the station, as needed. A typical schedule would be one trip per month with an estimated maximum of 24-hours of vessel time per trip.

Electricity is required for crew boat lights and other ancillary equipment, a generator equipped with a Kubota D1703BG engine, or similar, will provide the electricity for an anticipated maximum of 24-hours per month.

The operational period is expected to start in January 2011 and last for 24 months. Detailed emission calculations, equipment specifications and fuel types are presented in Appendix B.

Decommission and Removal

Once the requisite meteological data has been collected the SZ will be decommissioned from the site. During decommissioning, the installation process is basically reversed.

Estimated emissions during decommission/removal of the SZ are assumed to be equal to the emissions during installation.

2.1.1 Diesel Engines

Installation/Decommissioning

During installation and decommissioning of the SZ, the project will utilize several engines which will provide electricty, propulsion for the vessels and mechanical power to the equipment. A detailed listing of the engines is provided in Table 1-1. The equipment will be at (or near) the project site for the approximatly 2 days during installation and approximatly 2 days during decommissioning.

Operation

The two vessels that will service the SZ are equipped with the following make/model engines (or their equivalent) with power ratings as indicated:

- Caterpillar 3408 (600 hp)
- Kubota D1703BG (50 hp)
- Suzuki Outboard DF115 (115 hp)

The maximum heat input for each engine range from 0.35 to 4.20 MMBtu/hr, based on the higher heating value (HHV) of the marine diesel fuel. More complete details are provided in Appendix B.

2.2 Fuel

The internal reciprocating engines will utilize marine diesel fuel, with the exception of three gasoline powered units that will be used during installation and decommissioning. Marine diesel has an HHV of approximately 140,000 British thermal units per gallon (Btu/gal) on an annual average basis with a maximum sulfur content of 0.0015% by weight.

2.3 Source Emission Parameters

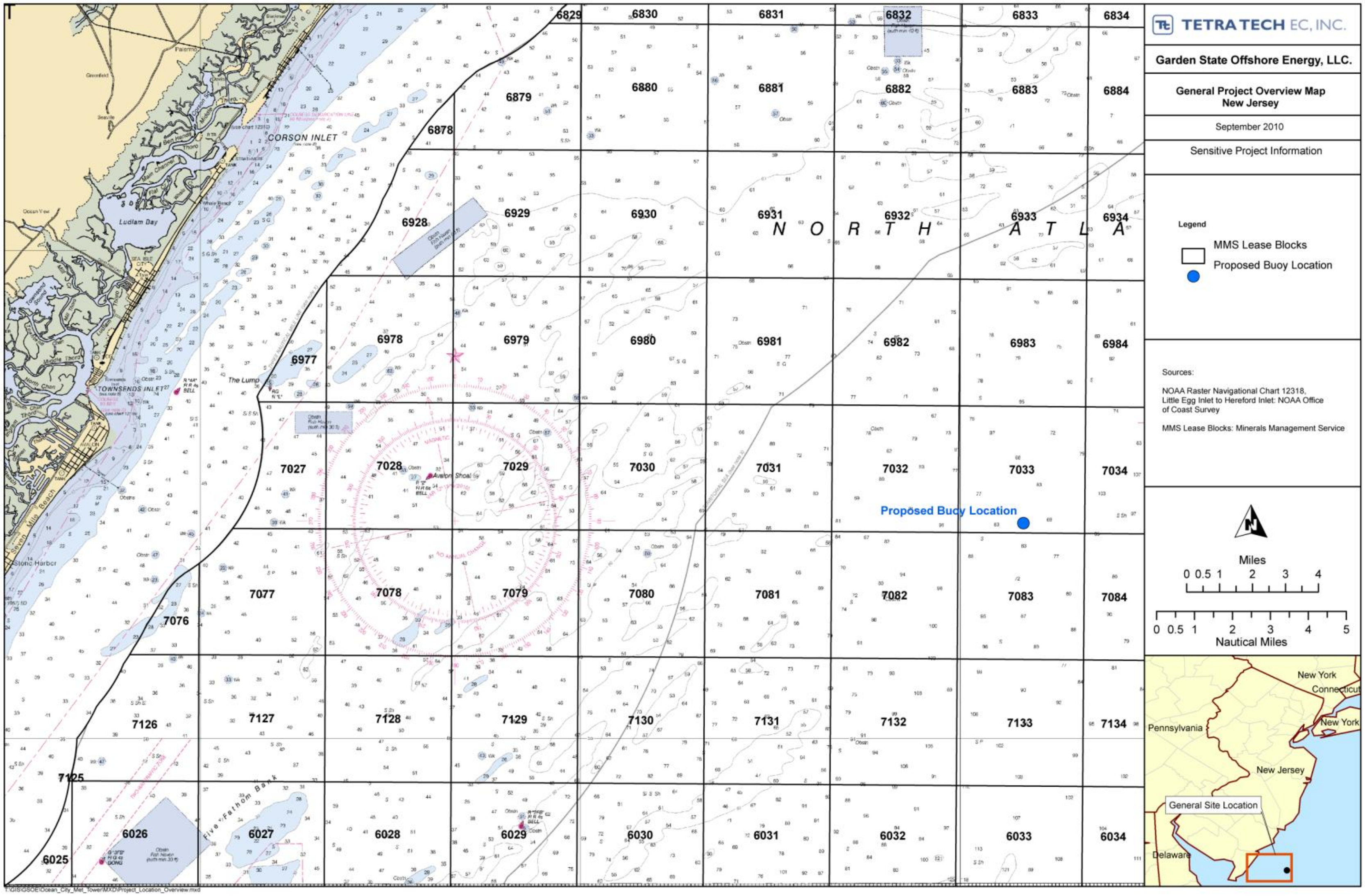
Emissions of air contaminants from the facility have been estimated based upon worst-case vendor emission estimates, mass balance calculations and AP-42 emission characterization methods. Emission calculations used to develop the emission estimates in this application are presented in Appendix B.

2.3.1 Short Term and Potential Emissions from the Diesel Engines

Emission estimates for the engines are presented in Appendix B. Emissions of air contaminants have been estimated based upon worst-case vendor emission estimates, mass balance calculations and AP-42 emission characterization methods. Worst-case SO_2 emission rates have been estimated based upon a mass balance of fuel sulfur loading (maximum of 0.0015% sulfur content of the marine diesel, by weight) for full load engine operations. Note that PM/PM-10/PM-2.5 emissions (it is assumed that all particulate emissions are less than 2.5 microns size range) include condensable particulate matter. Emissions of hazardous air pollutants (HAPs) from the diesel engines that maintain the buoy during the operation phase were estimated based on AP-42 5th Edition, Tables 3.3-2 and 3.4-4 for Gasoline and Diesel Industrial Engines (October 1996). HAPs from construction equipment are expected to be negligible due to the short duration of the construction phase and are therefore not presented in this application.

Please see Appendix B for detailed emission calculations.

Figure 2-1. Site Location Map



3.0 APPLICABLE REQUIREMENTS AND REQUIRED ANALYSES

This section identifies applicable federal and state air quality regulations and addresses the project's compliance. The specific regulations included in this review are the Federal New Source Performance Standards (NSPS) and Maximum Achievable Control Technology (MACT) requirements for HAPs and the NJDEP regulations and policy and New Jersey preconstruction permit requirements. This section also includes a determination of non-applicability of the following regulatory programs: Non-attainment NSR requirements, Prevention of Significant Deterioration (PSD) requirements, Air Quality Impacts Analysis requirements, NO_x RACT and NO_x Budget Program requirements.

3.1 Marine Engines

3.1.1 Compression Ignition Marine Engines

40 CFR Part 94 applies to marine engines that are compression ignition engines greater than or equal to 37 kW and manufactured on or after January 1, 2004. The following engines are subject to 40 CFR Part 94:

- Kubota SR613X
- Kubota D1703BG
- Suzuki Outboard DF115

Exhaust emissions for Category 2 engines having a displacement between 5 and 15 liters/cylinder are limited to 7.8 g/kW-hr for NO_x + HC emissions, 5.0 g/kW-hr for CO emissions and 0.27 g/kW-hr for PM emissions.

3.1.2 Spark Ignition Marine Engines

40 CFR Part 91 applies to marine engines that are spark ignition engines with a model year of 1998 and later. The Honda 4 stroke gasoline fired propulsion engine is subject to 40 CFR Part 91. Emission limitations are dependent upon the size of the engine and the model year.

NO_x + HC exhaust emissions in g/kW-hr for 2008 model year engines greater than 4.3 kW are limited based on the following equation:

$$(0.250 * (151 + 557/(kW)^{0.9})) + 6.00$$

3.2 Federal New Source Performance Standards, Subpart IIII

The NSPS are technology-based standards applicable to new and modified stationary sources. The NSPS requirements are established for approximately 70 source categories. NSPS Subpart IIII applies to stationary compression ignition internal combustion engines that are manufactured after April 1, 2006 and are not fire pump engines. Emission limitations are dependent upon the size of the engine and the date of manufacture. The Project will utilize engines that are subject to this rule. The Detroit Diesel 471 (2007) engine is subject to NSPS Subpart IIII. Exhaust emission limits are identified in Table B-2 of Appendix B.

In addition to the emission limitations identified in Appendix B, Subpart IIII limits the opacity from the engines to 20% and beginning October 1, 2010 limits the sulfur in fuel oil to maximum of 0.0015% by weight.

3.3 New Jersey Department of Environmental Protection Regulations and Policy

As previously stated, for OCS sources located within 25 miles of states' seaward boundaries, such as the proposed project, the requirements are the same as the requirements that would be applicable if the source were located in the corresponding onshore area (COA). Applicable regulations from Chapter 7:27 of the New Jersey Administrative Code are identified below:

- Subchapter 3 "Control and Prohibition of Smoke from Combustion of Fuel" – Subchapter 3 limits the opacity from marine engines and stationary internal combustion engines to less than 20% opacity, exclusive of visible condensed water vapor. Engines firing gasoline and No. 2 fuel oil with a maximum sulfur content of 0.0015% normally have opacity near zero. Therefore, the engines will be in compliance with this rule.

- Subchapter 4 "Control and Prohibition of Particles from Combustion of Fuel" – N.J.A.C. 7:27 - 4.2(a) limits the mass emission of particulates from fuel burning equipment having a maximum heat input rate of 1,000,000 Btu/hour. The maximum heat input of several pieces of construction equipment is greater than 1,000,000 Btu/hour. A complete list of emission units subject to Subchapter 4 along with their maximum heat input rates, emission limitations and projected emission rates is provided in Table 3-1. As illustrated, the project will comply with this regulation.

- Subchapter 8 "Permits and Certificates" – Requires a pre-construction permit to be obtained for the facility because the maximum heat input of some of the construction equipment is greater than 1,000,000 Btu/hr. Subchapter 8 requires that hazardous air pollutants or other air toxics be reported and evaluated if emissions exceed the reporting thresholds in Table B of Appendix 1 of Subchapter 8. HAP and air toxics emissions from the engines associated with the operating phase of the project are calculated in and compared to these thresholds in Table B-5 of Appendix B of this application. All air toxic emissions are below the NJDEP reporting thresholds.

- Subchapter 9 "Sulfur In Fuels" – N.J.A.C. 7:27 - 9.2 limits the sulfur content of fuel oil and SO_2 emissions from emission sources that combust fuel oil. The corresponding SZ will be located off the coast of Southern New Jersey, between Atlantic and Ocean counties. Both Atlantic and Ocean counties are classified as Zone 1 pursuant to N.J.A.C. 7:27-9.1. Since all engines combust No. 2 fuel oil, the maximum sulfur content of the No. 2 fuel oil allowed to be combusted in the emergency generators is 0.3% sulfur, by weight. The Project will use No. 2 fuel oil that complies with this regulation. Since the engines combust No. 2 fuel oil, the maximum SO_2 emissions allowed from the engines is 0.32 lb/MMBtu. The maximum proposed SO_2 emission limit of 0.0015 lb/MMBtu complies with this regulation.

3.4 Prevention of Significant Deterioration Requirements

The PSD regulations state that facilities subject to PSD review must perform an air quality analysis (which can include atmospheric dispersion modeling and preconstruction ambient air quality monitoring) and make a BACT demonstration for those pollutants that exceed the pollutant-specific significant emission rates identified in the regulations. A new source that is not among the 28 source categories identified in the PSD regulations, such as the proposed project, must have potential emissions of a regulated pollutant greater than 250 tons per year to be a major source subject to PSD review. In accordance with the OCS rules, all emissions from vessels servicing or associated with the OCS source shall be considered direct emissions from the source and accounted for in the source's potential to emit. Since the project's emissions (including vessel emissions) of PSD pollutants identified in Table 3-2 do not exceed 250 tons per year, the SZ is not considered a major source. Therefore, PSD regulations do not apply to the project.

3.5 Non-Attainment New Source Review Requirements

The existing air quality is based on conditions in the two nearest counties in New Jersey: Ocean and Atlantic counties. Ocean and Atlantic counties are currently designated as attainment or unclassifiable for SO_2, NO_2, CO, PM-10 and PM-2.5. However, both counties are designated as non-attainment for ozone (O_3). Pursuant to N.J.A.C. 7:27-18.2, an emissions increase of more than 25 tons per year of NO_x or VOC would subject the project to Non-Attainment NSR for these pollutants, which includes LAER and emission offset requirements. NO_x and VOC emissions from the facility are exempt from LAER and offset requirements, due to potential annual emissions from the project being less than their respective Non-Attainment NSR major source threshold. See Table 3-2.

3.6 Control and Prohibition of Air Pollution from Oxides of Nitrogen

Subchapter 19 contains New Jersey's NO_x RACT (Reasonably Available Control Technology) requirements that apply to existing as well as certain new equipment. NJDEP recently extended applicability of the NO_x RACT requirements of Subchapter 19 to equipment at non-major sources for certain types of equipment, and the applicability determinations have become more complex as a result. On and after March 7, 2007, stationary reciprocating engines are subject to the provisions of this subchapter if they are used for generating electricity and have a maximum rated power output of 37 kW or more, whether or not they are located at a major NO_x facility.

Subchapter 19 defines "stationary reciprocating engine" as an internal combustion engine that is a reciprocating engine that remains for more than 30 days at a single site (for example, any building, structure, facility, or installation), and: (1) Is not self-propelled, but may be mounted on a vehicle for portability; or (2) Is self-propelled on tracks at a facility, but does not in the course of its normal operation leave the facility. As described in the previous sections, there will be several internal combustion engines with a maximum output greater than 37 kW, however these engines will be at the mooring site for a period of no more than 2 days during installation and 2 days during decomissioning. As such, these engines do not meet the definition of "stationary reciprocating engine" and are not subject to NJDEP's NO_x RACT provisions.

3.7 NO_x Budget Program Requirements

New Jersey's NO_x Budget Program rule (Subpart 31) establishes a NO_x Budget Program in New Jersey which, beginning in 1999, limits emissions from stationary sources of NO_x. It sets forth requirements for the monitoring, recordkeeping, and reporting of NO_x emissions and for certification of compliance with this program. It makes available a trading mechanism, which allows intrastate trading as well as interstate trading. In order to support the trading mechanism, this subchapter establishes rules and procedures for the allocation of the tradable units (that is, allowances); the transfer, use, and retirement of the allowances; and the tracking of the allowances. The NO_x Budget Program set forth in this subchapter is intended to confirm with and meet U.S. EPA's NO_x Budget rules at 40 CFR 96 and meets U.S. EPA's requirements at 40 CFR 51.121 for mitigating the interstate transport of both ozone and nitrogen oxides, a precursor to the formation of ground-level ozone. Sources applicable to the program are referred to as "budget sources". Budget sources are defined as fossil fuel fired boilers and indirect heat exchangers of 250 mmBtu/hr or greater, and electric generating units of 15 megawatts, or greater. Since the engines do not qualify as budget sources, the project is not required to obtain NO_x emission allowances.

3.8 National Emission Standards for Hazardous Air Pollutants, Subpart ZZZZ

Some of the engines are subject to the National Emission Standards for Hazardous Air Pollutants (NESHAP), 40 CFR 63, Subpart ZZZZ for Reciprocating Internal Combustion Engines (RICE) because they were manufactured after the rule applicability date of June 12, 2006. Compliance with NSPS, Subpart IIII satisfies all the requirements of this Subpart.

Table 3-1: Subchapter 4 Applicability and Compliance Summary

Construction Engine Make/Model	Maximum Heat Input (MMBtu/hr)	PM Maximum Allowable Emission Rate (lb/hr)	Proposed PM Emission rate (lb/hr)
Caterpillar 3412	5.60	3.36	1.76
Detroit Diesel 471	1.69	1.02	0.53
Cummins 9310	2.98	1.79	0.94
John Deere PR2-8	1.05	0.63	0.33
Honda 4-Stroke	1.05	0.63	0.07
Caterpillar 3408	4.20	2.52	1.32

Table 3-2: Comparison of GSOE Potential Facility Emissions to PSD and Non-Attainment NSR Thresholds

Pollutant	Project Potential Emissions (tons/year)	PSD Major Source Thresholds (tons/yr)	Non-Attainment NSR Major Source Thresholds (tons/yr)	Subject to PSD/NNSR Review (Yes/No)
Nitrogen Oxides[1]	4.33	250	25	No
Carbon Monoxide	1.11	250	N/A	No
Volatile Organic Compounds [1]	0.71	250	25	No
Sulfur Dioxide	0.012	250	N/A	No
Particulate Matter (PM)	0.293	250	N/A	No
PM-10	0.293	250	N/A	No
PM-2.5	0.293	250	N/A	No

[1]Precursor pollutant to ozone.

APPENDIX A

COPY OF NOTICE OF INTENT

1200 Wall Street West
2nd Floor
Lyndhurst, NJ 07071

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www.TRCsolutions.com

September 14, 2010

Mr. Steven Riva
Chief, Permitting Section
U.S. Environmental Protection Agency
290 Broadway, 25th Floor
New York, NY 10007

Mr. John Preczewski
Assistant Director
New Jersey Department of Environmental Protection
Bureau of Operating Permits
P.O. Box 027
401 East State Street – 2nd Floor
Trenton, NJ 08625

**Subject: Garden State Offshore Energy
Revised Notice of Intent (NOI) for the Proposed Offshore SeaZephIR™ Spar Buoy**

Dear Sirs:

TRC Environmental Corporation (TRC) is submitting this Notice of Intent (NOI) to submit an application for a pre-construction and operating permit pursuant to 40 CFR Part 55.4 on behalf of Garden State Offshore Energy (GSOE). This submittal updates/revises the NOI that was submitted on September 16, 2009.

General Company Information

GSOE is a joint venture of PSEG Renewable Generation and Deepwater Wind LLC.

The contact information for the Responsible Official is:

Robert Gibbs
GSOE
36-42 Newark Street, Suite 402
Hoboken, NJ 07030
Phone: (973) 430-7985
Email: Robert.Gibbs@pseg.com

The permitting contact for the Project is:

Aileen Kenney, Director of Permitting
Deepwater Wind, LLC
56 Exchange Terrace, Suite 101
Providence, RI. 02903 - 1772
Phone: (401) 648 0607
Fax: (401) 228 8004
Email: akenney@dwwind.com

Project/Facility Description

To help achieve the goals set forth in New Jersey's Energy Master Plan, GSOE plans to build a wind farm off the coast of Southern New Jersey (two digit SIC Code of 49). Prior to construction of the wind farm, it is essential to collect and analyze site-specific data to use in the engineering and design of the wind farm. As such, GSOE is proposing to install and operate a buoy based light detection and ranging (LIDAR) system, approximately 20 miles offshore, at or near the following location:

MMS Block 7033 - 39° 04' 42" N, 74° 18' 34" W

A map of the location is presented in Figure 1. As shown in the figure, all activities will occur in federal Outer Continental Shelf (OCS) waters.

The SeaZephIR™ (SZ) is a floating spar buoy platform approximately 100 feet in length and 9 feet in diameter. The superstructure of the SZ is designed for deployment in harsh marine conditions while offering maximum stability through the use of an on-board ballasting mechanism that will reach approximately 60 feet below the ocean surface. The buoy is moored to the ocean floor via a single clump weight anchor. A main mooring line, safety line and yaw stabilizer line will be connected to the clump weight anchor to the base of the buoy. Approximately 30 – 40 feet of the SZ will be above the ocean surface and will house the LIDAR equipment, power sources (battery and wind micro-turbines), and passive acoustic monitoring systems.

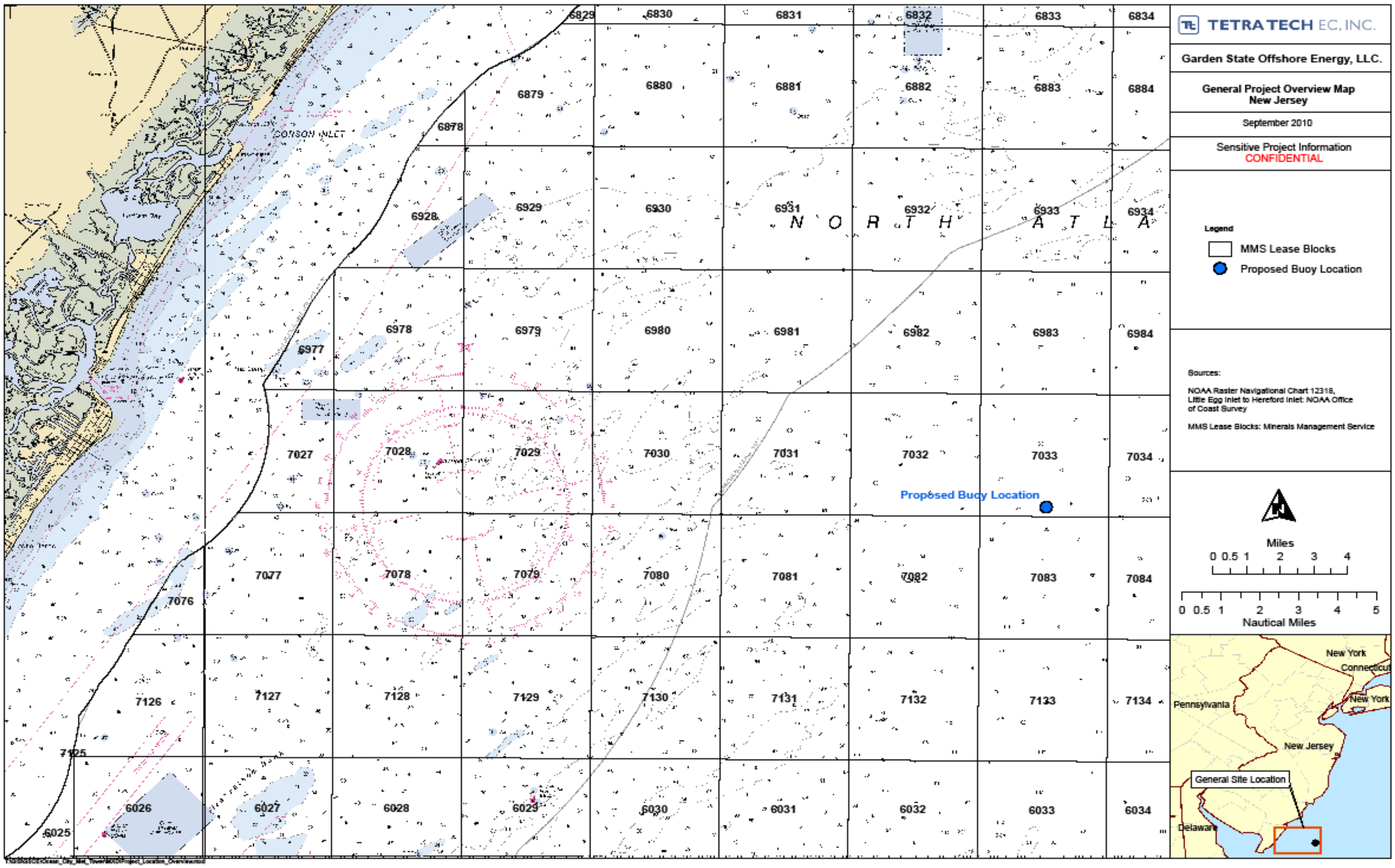
Estimated Emissions

The project will consist of three phases: installation, operation, and decommission.

Installation

The concrete clump weight mooring will be fabricated at a local NJ marine yard. Upon completion, the mooring will be pre-set at the site via a 4-point crane barge supported by an anchor handling tug. The spar buoy will then be towed to the site, ballasted to the vertical plane and connected to the mooring. Estimated emissions during installation of the SZ were evaluated and are summarized in Tables A-1 through A-3. Refer to Appendix A for complete details on installation equipment, emission calculations and fuel types. Appendix A also contains estimates on the types of fuel used in the equipment. No add-on air pollution equipment is proposed for the installation equipment. Installation is expected to occur over a period of approximately 2 days.

Figure 1: SeaZephIR™ Spar Buoy Location



Operation

There will be no emissions associated with the operation of the SZ. Power to operate the instruments on the SZ will be provided by batteries, solar panels, and wind micro-turbines. During the operational period, GSOE will use a crew boat to service and maintain the station as needed. A typical schedule would be one trip per month.

Detailed emission calculations, equipment specifications and fuel types are presented in Appendix A.

Decommission and Removal

Once the requisite met data has been collected the spar buoy shall be decommissioned from the site. During decommissioning, the installation process is basically reversed. Estimated emissions during decommission/removal of the SZ station are assumed to be equal to the emissions during installation.

Total emissions from the SZ project are summarized in the following table.

Pollutant	Emissions (tons/year)			
	Installation	Operation	Decommission	Total[1]
NO_x	1.799	2.971	1.799	4.77
CO	0.576	0.792	0.576	1.37
VOC	0.426	0.510	0.426	0.94
SO_2	5.27×10^{-3}	1.17×10^{-3}	5.27×10^{-3}	6.45×10^{-3}
PM	0.131	0.214	0.131	0.35
PM-10	0.131	0.214	0.131	0.35
PM-2.5	0.131	0.214	0.131	0.35

Notes:
[1] Total annual emissions are the sum of emissions during installation OR decommission (since the installation and decommission phases will not occur within the same year) and emissions during operation.
[2] Proposed limitations (e.g. fuel sulfur content, equipment operating hours) are identified in Appendix A.
[3] Since air dispersion modeling is not required, information regarding stack parameters is not included.

Prevention of Significant Deterioration (PSD)/Non-Attainment New Source Review (NNSR) Applicability Analysis

The existing air quality for the project site is established based on conditions in the two nearest counties in New Jersey: Ocean and Atlantic counties. Ocean and Atlantic counties are designated as attainment or unclassifiable for sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), particulate matter less than 10 microns (PM-10) and particulate matter less than 2.5 microns (PM-2.5). Both counties are designated as moderate non-attainment for ozone. Therefore, facilities with annual emissions greater than 25 tons of nitrogen oxides (NO_x) or 25 tons of volatile organic compounds (VOC), which are precursors of ozone, are subject to NNSR. Since the proposed project is considered a new facility and is not one of the 28 source categories identified in the PSD regulations, the proposed project would need to have potential emissions of a regulated pollutant greater than 250 tons per year to be a major source subject to PSD. The following table compares the expected potential annual emissions of the proposed project to the PSD/NNSR thresholds discussed above.

Pollutant	Project Potential Emissions (tons/yr)	PSD Major Source Threshold (tons/yr)	NNSR Major Source Threshold (tons/yr)[1]	Subject to PSD/NNSR Review? (Yes/No)
NO_x	4.77	250	25	No
CO	1.37	250	N/A	No
VOC	0.94	250	25	No
SO_2	6.45×10^{-3}	250	N/A	No
PM	0.35	250	N/A	No
PM-10	0.35	250	N/A	No
PM-2.5	0.35	250	N/A	No

Notes:
[1]*Per N.J.A.C 7:27-18.*

As illustrated above, potential emissions from the proposed project are below applicable PSD and NNSR major source thresholds. Should you have any questions regarding this NOI please contact me at (201) 933-5541, extension 142.

Sincerely,
TRC

Carla Adduci
Principal Air Quality Engineer

Attachment

cc: R. Gibbs, PSEG
K. Strait, PSEG
A. Kenney, Deepwater Wind
F. Steitz, NJDEP

Appendix A

Equipment Details and Emission Calculations

Table A-1
Garden State Offshore Energy
SeaZephIR™ Spar Buoy Equipment List

Equipment Make/Model	Maximum Rated Power hp	Maximum Rated Power kW	Heat Input MMBtu/hr[1]	Operating Hours	Fuel Type	Purpose
Installation Equipment:						
Caterpillar 3412	600	447	4.20	112	marine diesel	Tug main engine - marine propulsion
Kubota SR613X	50	37	0.35	140	marine diesel	Tug generator - electrical power
Yanmar HT210A	7.5	6	0.05	75	marine diesel	Portable barge generator - electrical power
Detroit Diesel 471	242	180	1.69	30	marine diesel	Deck engine for winch - mechanical power
Detroit Diesel 471	242	180	1.69	30	marine diesel	Deck engine for winch - mechanical power
Deutz TCD 2013	125	93	0.88	80	marine diesel	Welding arc power - portable engine
Deutz TCD 2013	125	93	0.88	80	marine diesel	Welding arc power - portable engine
Cummings 9310	425	317	2.98	60	marine diesel	Crane engine - mechanical power
Yanmar 903	9	7	0.06	20	marine diesel	Diver's air supply - portable engine
Lister 3475	34	25	0.24	20	marine diesel	Diver's air supply - portable engine
John Deere PR2-8	150	112	1.05	15	marine diesel	Air tools - portable engine
Briggs & Stratton 1550	18	13	0.13	40	gasoline	Dewatering pump - portable engine
Honda 4 stroke	150	112	1.05	100	gasoline	Outboard motor - marine propulsion
Honda 4 stroke	40	30	0.28	20	gasoline	Outboard motor - marine propulsion
Kubota 309	28	21	0.20	20	marine diesel	Personnel hoisting - portable engine
Operation & Maintenance Equipment:						
Caterpillar 3408	600	447	4.20	24 hrs/month	marine diesel	Vessel Propulsion - marine engine
Kubota D1703BG	50	37	0.35	24 hrs/month	marine diesel	Tug generator - electrical power
Suzuki Outboard DF115	115	86	0.81	24 hrs/month	marine diesel	Vessel Propulsion - marine engine

[1] Assumed heat rate of 7,000 Btu/hp-hr from AP-42 Sections 3.3 & 3.4

Table A-2
Garden State Offshore Energy
Equipment Emission Factors

Equipment Make/Model	Year of Manufacture	Emission Factors NOx		CO		VOC		PM/PM-10/ PM-2.5		SO2[1]		Reference
Caterpillar 3412	1990	0.031	lb/hp-hr	0.00668	lb/hp-hr	0.00251	lb/hp-hr	0.0022	lb/hp-hr	0.0015	lb/MMBtu	AP-42
Kubota SR613X	2009	7.8	g/kW-hr	5.0	g/kW-hr	7.8	g/kW-hr	0.27	g/kW-hr	0.0015	lb/MMBtu	40 CFR 94.8 Category 2
Yanmar HT210A	2003	7.5	g/kW-hr	8	g/kW-hr	7.5	g/kW-hr	0.8	g/kW-hr	0.0015	lb/MMBtu	40 CFR 89.112 Tier 2
Detroit Diesel 471	2002	9.2	g/kW-hr	11.4	g/kW-hr	1.3	g/kW-hr	0.54	g/kW-hr	0.0015	lb/MMBtu	40 CFR 89.112 Tier 1
Detroit Diesel 471	2007	4.0	g/kW-hr	3.5	g/kW-hr	4.0	g/kW-hr	0.2	g/kW-hr	0.0015	lb/MMBtu	40 CFR 89.112 Tier 3
Deutz TCD 2013	2001	9.2	g/kW-hr	0.00668	lb/hp-hr	0.00251	lb/hp-hr	0.0022	lb/hp-hr	0.0015	lb/MMBtu	40 CFR 89.112 Tier 1
Deutz TCD 2013	2008	4	g/kW-hr	5.0	g/kW-hr	4.0	g/kW-hr	0.3	g/kW-hr	0.0015	lb/MMBtu	40 CFR 89.112 Tier 3
Cummings 9310	1987	0.031	lb/hp-hr	0.00668	lb/hp-hr	0.00251	lb/hp-hr	0.0022	lb/hp-hr	0.0015	lb/MMBtu	AP-42
Yanmar 903	2002	10.5	g/kW-hr	8.0	g/kW-hr	10.5	g/kW-hr	1.0	g/kW-hr	0.0015	lb/MMBtu	40 CFR 89.112 Tier 1
Lister 3475	1998	0.031	lb/hp-hr	0.00668	lb/hp-hr	0.00251	lb/hp-hr	0.0022	lb/hp-hr	0.0015	lb/MMBtu	AP-42
John Deere PR2-8	2000	9.2	g/kW-hr	0.00668	lb/hp-hr	0.00251	lb/hp-hr	0.0022	lb/hp-hr	0.0015	lb/MMBtu	40 CFR 89.112 Tier 1/AP-42
Briggs & Stratton 1550	2004	9.5	g/kW-hr	6.6	g/kW-hr	9.5	g/kW-hr	0.8	g/kW-hr	0.0840	lb/MMBtu	AP-42
Honda 4 stroke	2008	7.8	g/kW-hr	5.0	g/kW-hr	7.8	g/kW-hr	0.27	g/kW-hr	0.0840	lb/MMBtu	AP-42
Honda 4 stroke	2008	7.8	g/kW-hr	5.0	g/kW-hr	7.8	g/kW-hr	0.27	g/kW-hr	0.0840	lb/MMBtu	AP-42
Kubota 309	2006	7.5	g/kW-hr	5.5	g/kW-hr	7.5	g/kW-hr	0.6	g/kW-hr	0.0015	lb/MMBtu	40 CFR 89.112 Tier 2
Caterpillar 3408	2003	0.031	lb/hp-hr	0.00668	lb/hp-hr	0.00251	lb/hp-hr	0.0022	lb/hp-hr	0.0015	lb/MMBtu	AP-42
Kubota D1703BG	2009	7.5	g/kW-hr	5.5	g/kW-hr	7.5	g/kW-hr	0.6	g/kW-hr	0.0015	lb/MMBtu	40 CFR 94.8 Category 2
Suzuki Outboard DF115	2008	7.5	g/kW-hr	5.5	g/kW-hr	7.5	g/kW-hr	0.6	g/kW-hr	0.0015	lb/MMBtu	40 CFR 94.8 Category 2

[1] All engines will combust either marine diesel fuel with a maximum sulfur content of 0.0015% sulfur by weight or gasoline.

[2] Emissions of SO_2 from oil fired units based on mass balance of sulfur in fuel:

Sulfur Content	0.0015	% sulfur
Higher Heating Value	140,000	Btu/Gal
Assumed Heat Rate	7,000	Btu/hp-hr (per AP-42 Sections 3.3 & 3.4)
Density of Oil	7.1	lb/gal
Molecular Weight of S	32	lb/lbmol
Molecular Weight of SO_2	64	lb/lbmol

Table A-3
Garden State Offshore Energy
Emissions from Installation

Equipment Make/Model	Emissions (tons/yr)				
	NOx	CO	VOC	PM/PM-10/ PM-2.5	SO2[1,2]
Caterpillar 3412	1.042	0.224	0.084	7.39E-02	3.73E-05
Kubota SR613X	0.045	0.029	0.045	1.55E-03	3.73E-05
Yanmar HT210A	0.003	0.004	0.003	3.70E-04	3.00E-06
Detroit Diesel 471	0.055	0.068	0.008	3.22E-03	3.87E-05
Detroit Diesel 471	0.024	0.021	0.024	1.19E-03	3.87E-05
Deutz TCD 2013	0.076	0.033	0.013	1.10E-02	5.33E-05
Deutz TCD 2013	0.033	0.041	0.033	2.47E-03	5.33E-05
Cummings 9310	0.395	0.085	0.032	2.81E-02	1.36E-04
Yanmar 903	0.002	0.001	0.002	1.48E-04	9.59E-07
Lister 3475	0.011	0.002	0.001	7.48E-04	3.62E-06
John Deere PR2-8	0.017	0.008	0.003	2.48E-03	1.20E-05
Briggs & Stratton 1550	0.006	0.004	0.006	4.73E-04	2.12E-04
Honda 4 stroke	0.096	0.062	0.096	3.33E-03	4.41E-03
Honda 4 stroke	0.005	0.003	0.005	1.78E-04	2.35E-04
Kubota 309	0.003	0.003	0.003	2.76E-04	2.98E-06
Total Installation	**1.812**	**0.588**	**0.358**	**1.29E-01**	**5.27E-03**

[1] All engines will combust either marine diesel fuel with a maximum sulfur content of 0.0015% sulfur by weight or gasoline.

[2] Emissions of SO_2 from oil fired units based on mass balance of sulfur in fuel:

Sulfur Content	0.0015	% sulfur
Higher Heating Value	140,000	Btu/Gal
Assumed Heat Rate[3]	7,000	Btu/hp-hr (per AP-42 Sections 3.3 & 3.4)
Density of Oil	7.1	lb/gal
Molecular Weight of S	32	lb/lbmol
Molecular Weight of SO_2	64	lb/lbmol

[3] Assumed heat rate from AP-42 Sections 3.3 & 3.4.

Table A-4
Garden State Offshore Energy
Annual Emissions from Operation & Maintenance

Make/Model	Emissions (tons/yr)				
	NOx	CO	VOC	2.5	SO2[1,2]
Caterpillar 3408	2.678	0.577	0.217	0.190	9.20E-04
Kubota D1703BG	0.089	0.065	0.089	7.10E-03	7.67E-05
Suzuki Outboard DF115	0.204	0.150	0.204	1.63E-02	1.76E-04
Total O&M Emissions	**2.971**	**0.792**	**0.510**	**2.14E-01**	**1.17E-03**

[1] All engines will combust either marine diesel fuel with a maximum sulfur content of 0.0015% sulfur by weight or gasoline.

[2] Emissions of SO_2 from oil fired units based on mass balance of sulfur in fuel:

Sulfur Content	0.0015	% sulfur
Higher Heating Value	140,000	Btu/Gal
Assumed Heat Rate[3]	7,000	Btu/hp-hr (per AP-42 Sections 3.3 & 3.4)
Density of Oil	7.1	lb/gal
Molecular Weight of S	32	lb/lbmol
Molecular Weight of SO_2	64	lb/lbmol

[3] Assumed heat rate from AP-42 Sections 3.3 & 3.4.

APPENDIX B

EMISSION CALCULATIONS

Table B-1
Garden State Offshore Energy
SeaZephIR™ Spar Buoy Equipment List

Equipment Make/Model (or equivalent)	Maximum Rated Power		Maximum Heat Input	Operating Hours			Fuel Type	Purpose
	hp	kW	MMBtu/hr[1]	As OCS Source	As non-OCS Source	Total		
Installation Equipment:								
Caterpillar 3412	800	597	5.60	0	80	80	marine diesel	Tug main engine - marine propulsion
Kubota SR613X	50	37	0.35	48	80	128	marine diesel	Tug generator - electrical power
Yanmar HT210A	7.5	6	0.05	38	38	76	marine diesel	Portable barge generator - electrical power
Detroit Diesel 471	242	180	1.69	16	15	31	marine diesel	Deck engine for winch - mechanical power
Detroit Diesel 471	242	180	1.69	15	15	30	marine diesel	Deck engine for winch - mechanical power
Deutz TCD 2013	125	93	0.88	12	0	12	marine diesel	Welding arc power - portable engine
Cummins 9310	425	317	2.98	10	0	10	marine diesel	Crane engine - mechanical power
Yanmar 903	9	7	0.06	20	0	20	marine diesel	Diver's air supply - portable engine
Lister 3475	34	25	0.24	20	0	20	marine diesel	Diver's air supply - portable engine
John Deere PR2-8	150	112	1.05	15	0	15	marine diesel	Air tools - portable engine
Briggs & Stratton 1550	18	13	0.13	18	0	18	gasoline	Water pump system- portable engine
Honda 4 stroke	150	112	1.05	24	0	24	gasoline	Outboard motor - marine propulsion
Operation & Maintenance Equipment:								
Caterpillar 3408	600	447	4.20	N/A	24 hrs/month	24 hrs/month	marine diesel	Vessel Propulsion - marine engine
Kubota D1703BG	50	37	0.35	N/A	24 hrs/month	24 hrs/month	marine diesel	Crew boat generator - mechanical power
Suzuki Outboard DF115	115	86	0.81	N/A	24 hrs/month	24 hrs/month	gasoline	Vessel Propulsion - marine engine

[1] Assumed heat rate of 7,000 Btu/hp-hr from AP-42 Sections 3.3 & 3.4

Table B-2
Garden State Offshore Energy SeaZephIRTM Spar Buoy
Equipment Emission Factors

Equipment Make/Model	Year of Manufacture	Emission Factors										
		NOx		CO		VOC		PM/PM-10/ PM-2.5		SO2[1]		Emission Factor Basis
Caterpillar 3412	1990	0.031	lb/hp-hr	0.00668	lb/hp-hr	0.00251	lb/hp-hr	0.0022	lb/hp-hr	0.0015	lb/MMBtu	AP-42
Kubota SR613X	2009	7.8	g/kW-hr	5.0	g/kW-hr	7.8	g/kW-hr	0.27	g/kW-hr	0.0015	lb/MMBtu	40 CFR 94.8 Category 2
Yanmar HT210A	2003	0.031	lb/hp-hr	0.00668	lb/hp-hr	0.00251	lb/hp-hr	0.0022	lb/hp-hr	0.0015	lb/MMBtu	AP-42
Detroit Diesel 471	2002	0.031	lb/hp-hr	0.00668	lb/hp-hr	0.00251	lb/hp-hr	0.0022	lb/hp-hr	0.0015	lb/MMBtu	AP-42
Detroit Diesel 471	2007	4.0	g/kW-hr	3.5	g/kW-hr	4.0	g/kW-hr	0.2	g/kW-hr	0.0015	lb/MMBtu	Subpart IIII
Deutz TCD 2013	2001	0.031	lb/hp-hr	0.00668	lb/hp-hr	0.00251	lb/hp-hr	0.0022	lb/hp-hr	0.0015	lb/MMBtu	AP-42
Cummins 9310	1987	0.031	lb/hp-hr	0.00668	lb/hp-hr	0.00251	lb/hp-hr	0.0022	lb/hp-hr	0.0015	lb/MMBtu	AP-42
Yanmar 903	2002	0.031	lb/hp-hr	0.00668	lb/hp-hr	0.00251	lb/hp-hr	0.0022	lb/hp-hr	0.0015	lb/MMBtu	AP-42
Lister 3475	1998	0.031	lb/hp-hr	0.00668	lb/hp-hr	0.00251	lb/hp-hr	0.0022	lb/hp-hr	0.0015	lb/MMBtu	AP-42
John Deere PR2-8	2000	0.031	lb/hp-hr	0.00668	lb/hp-hr	0.00251	lb/hp-hr	0.0022	lb/hp-hr	0.0015	lb/MMBtu	AP-42
Briggs & Stratton 1550	2004	9.5	g/kW-hr	6.6	g/kW-hr	9.5	g/kW-hr	0.8	g/kW-hr	0.0840	lb/MMBtu	AP-42
Honda 4 stroke	2008	7.8	g/kW-hr	5.0	g/kW-hr	7.8	g/kW-hr	0.27	g/kW-hr	0.0840	lb/MMBtu	40 CFR 91.104/AP-42
Caterpillar 3408	2003	0.031	lb/hp-hr	0.00668	lb/hp-hr	0.00251	lb/hp-hr	0.0022	lb/hp-hr	0.0015	lb/MMBtu	AP-42
Kubota D1703BG	2009	7.8	g/kW-hr	5.0	g/kW-hr	7.8	g/kW-hr	0.27	g/kW-hr	0.0015	lb/MMBtu	40 CFR 94.8 Category 2
Suzuki Outboard DF115	2008	7.8	g/kW-hr	5.0	g/kW-hr	7.8	g/kW-hr	0.27	g/kW-hr	0.0840	lb/MMBtu	40 CFR 91.104/AP-42

[1] All engines will combust either marine diesel fuel with a maximum sulfur content of 0.0015% sulfur by weight or gasoline.

[2] Emissions of SO_2 from oil fired units based on mass balance of sulfur in fuel:

Sulfur Content	0.0015	% sulfur
Higher Heating Value	140,000	Btu/Gal
Assumed Heat Rate	7,000	Btu/hp-hr (per AP-42 Sections 3.3 & 3.4)
Density of Oil	7.1	lb/gal
Molecular Weight of S	32	lb/lbmol
Molecular Weight of SO_2	64	lb/lbmol

Table B-3
Garden State Offshore Energy SeaZephIRTM Spar Buoy
Emissions from Installation

Equipment Make/Model	Emissions (tons/yr)				
	NOx	**CO**	**VOC**	**PM/PM-10/ PM-2.5**	**SO2[1,2]**
Caterpillar 3412	0.992	0.214	0.080	7.04E-02	3.41E-05
Kubota SR613X	0.041	0.026	0.041	1.42E-03	3.41E-05
Yanmar HT210A	0.009	0.002	0.001	6.27E-04	3.04E-06
Detroit Diesel 471	0.116	0.025	0.009	8.25E-03	3.99E-05
Detroit Diesel 471	0.024	0.021	0.024	1.19E-03	3.87E-05
Deutz TCD 2013	0.023	0.005	0.002	1.65E-03	7.99E-06
Cummins 9310	0.066	0.014	0.005	4.68E-03	2.26E-05
Yanmar 903	0.003	0.001	0.000	1.98E-04	9.59E-07
Lister 3475	0.011	0.002	0.001	7.48E-04	3.62E-06
John Deere PR2-8	0.035	0.008	0.003	2.48E-03	1.20E-05
Briggs & Stratton 1550	0.003	0.002	0.003	2.13E-04	9.53E-05
Honda 4 stroke	0.023	0.015	0.023	7.99E-04	1.06E-03
Total Installation	**1.345**	**0.334**	**0.192**	**9.27E-02**	**1.35E-03**

[1] All engines will combust either marine diesel fuel with a maximum sulfur content of 0.0015% sulfur by weight or gasoline.

[2] Emissions of SO_2 from oil fired units based on mass balance of sulfur in fuel:

Sulfur Content	0.0015	% sulfur
Higher Heating Value	140,000	Btu/Gal
Assumed Heat Rate[3]	7,000	Btu/hp-hr (per AP-42 Sections 3.3 & 3.4)
Density of Oil	7.1	lb/gal
Molecular Weight of S	32	lb/lbmol
Molecular Weight of SO_2	64	lb/lbmol

[3] Assumed heat rate from AP-42 Sections 3.3 & 3.4.

Table B-4
Garden State Offshore Energy SeaZephIRTM Spar Buoy
Annual Emissions from Operation & Maintenance

Equipment Make/Model	Emissions (tons/yr)				
	NOx	**CO**	**VOC**	**PM/PM-10/ PM-2.5**	**SO2[1,2]**
Caterpillar 3408	2.678	0.577	0.217	0.190	9.20E-04
Kubota D1703BG	0.092	0.059	0.092	3.20E-03	7.67E-05
Suzuki Outboard DF115	0.212	0.136	0.212	7.35E-03	9.74E-03
Total O&M Emissions	**2.983**	**0.772**	**0.522**	**2.01E-01**	**1.07E-02**

[1] All engines will combust either marine diesel fuel with a maximum sulfur content of 0.0015% sulfur by weight or gasoline.

[2] Emissions of SO_2 from oil fired units based on mass balance of sulfur in fuel:

Sulfur Content	0.0015	% sulfur
Higher Heating Value	140,000	Btu/Gal
Assumed Heat Rate[3]	7,000	Btu/hp-hr (per AP-42 Sections 3.3 & 3.4)
Density of Oil	7.1	lb/gal
Molecular Weight of S	32	lb/lbmol
Molecular Weight of SO_2	64	lb/lbmol

[3] Assumed heat rate from AP-42 Sections 3.3 & 3.4.

Table B-5
Garden State Offshore Energy SeaZephIR™ Spar Buoy
Meteorological Station HAP Emissions from Operation

Engine parameters

Engine Make/Model		Caterpillar 3408	Kubota D1703BG	Suzuki Outboard DF115
Number of Engines[1]		1	1	1
Maximum Rated Power Output	hp	600	50	115
Power output base load	kW	447	37	86
Fuel		Diesel	Diesel	Gasoline
Fuel Firing Rate	Gal/hr	30.0	2.5	
Heat Input Rate	MMBtu/hr	4.20	0.35	0.81
Maximum Operation	hr/month	24	24	24
	months/yr	12	12	12
	hr/yr	288	288	288

Hazardous Air Pollutants	EF Basis [1] lb/MMBtu	EF Basis [2] lb/MMBtu	Max Hourly Emissions Caterpillar 3408 lb/hr	Max Hourly Emissions Kubota D1703BG lb/hr	Max Hourly Emissions Suzuki Outboard DF115 lb/hr	Total Project PTE tons/yr	Total Project PTE lb/yr	Subchapter 8 Reporting Threshold lb/yr
Benzene	9.33E-04	1.58E-03	3.92E-03	3.27E-04	1.27E-03	7.9E-04	1.589	[0.01 lb/hr]
Toluene	4.09E-04	5.58E-04	1.72E-03	1.43E-04	4.49E-04	3.3E-04	0.665	2,000
Xylenes	2.85E-04	1.95E-04	1.20E-03	9.98E-05	1.57E-04	2.1E-04	0.419	2,000
1,3-Butadiene	3.91E-05	6.63E-04	1.64E-04	1.37E-05	5.34E-04	1.0E-04	0.205	14
Formaldehyde	1.18E-03	2.05E-02	4.96E-03	4.13E-04	1.65E-02	3.1E-03	6.299	400
Acetaldehyde	7.67E-04	2.79E-03	3.22E-03	2.68E-04	2.25E-03	8.3E-04	1.652	1,800
Acrolein	9.25E-05	2.63E-03	3.89E-04	3.24E-05	2.12E-03	3.7E-04	0.731	8
1,1,2,2-Tetrachloroethane		2.53E-05	0.00E+00	0.00E+00	2.04E-05	2.9E-06	0.006	[0.01 lb/hr]
1,1,2-Trichloroethane		1.53E-05	0.00E+00	0.00E+00	1.23E-05	1.8E-06	0.004	[0.01 lb/hr]
1,3-Dichloropropene		1.27E-05	0.00E+00	0.00E+00	1.02E-05	1.5E-06	0.003	200
Carbon Tetrachloride		1.77E-05	0.00E+00	0.00E+00	1.42E-05	2.1E-06	0.004	[0.01 lb/hr]
Chlorobenzene		1.29E-05	0.00E+00	0.00E+00	1.04E-05	1.5E-06	0.003	2,000
Chloroform		1.37E-05	0.00E+00	0.00E+00	1.10E-05	1.6E-06	0.003	[0.01 lb/hr]
Ethylbenzene		2.48E-05	0.00E+00	0.00E+00	2.00E-05	2.9E-06	0.006	2,000
Ethylene Dibromide		2.13E-05	0.00E+00	0.00E+00	1.71E-05	2.5E-06	0.005	[0.01 lb/hr]
Methanol		3.06E-03	0.00E+00	0.00E+00	2.46E-03	3.5E-04	0.709	2,000
Methylene Chloride		4.12E-05	0.00E+00	0.00E+00	3.32E-05	4.8E-06	0.010	2,000
Styrene		1.19E-05	0.00E+00	0.00E+00	9.58E-06	1.4E-06	0.003	200
Vinyl Chloride		7.18E-06			5.78E-06	8.3E-07	0.002	40
Polycyclic aromatic hydrocarbons (PAH)								
Napthalene	8.48E-05	9.71E-05	3.56E-04	2.97E-05	7.82E-05	6.7E-05	0.1336	2,000
Acenaphthylene	5.06E-06		2.13E-05	1.77E-06	0.00E+00	3.3E-06	0.0066	
Acenaphthene	1.42E-06		5.96E-06	4.97E-07	0.00E+00	9.3E-07	0.0019	
Fluorene	2.92E-05		1.23E-04	1.02E-05	0.00E+00	1.9E-05	0.0383	
Phenanthene	2.94E-05		1.23E-04	1.03E-05	0.00E+00	1.9E-05	0.0385	
Anthracene	1.87E-06		7.85E-06	6.55E-07	0.00E+00	1.2E-06	0.0025	
Fluoranthene	7.61E-06		3.20E-05	2.66E-06	0.00E+00	5.0E-06	0.0100	
Pyrene	4.78E-06		2.01E-05	1.67E-06	0.00E+00	3.1E-06	0.0063	
Benzo(a)anthracene	1.68E-06		7.06E-06	5.88E-07	0.00E+00	1.1E-06	0.0022	
Chrysene	3.53E-07		1.48E-06	1.24E-07	0.00E+00	2.3E-07	0.0005	
Benzo(b)fluoranthene	9.91E-08		4.16E-07	3.47E-08	0.00E+00	6.5E-08	0.0001	
Benzo(k)fluoranthene	1.55E-07		6.51E-07	5.43E-08	0.00E+00	1.0E-07	0.0002	
Benzo(a)pyrene	1.88E-07		7.90E-07	6.58E-08	0.00E+00	1.2E-07	0.0002	
Indeno(1,2,3-cd)pyrene	3.75E-07		1.58E-06	1.31E-07	0.00E+00	2.5E-07	0.0005	
Dibenz(a,h)anthracene	5.83E-07		2.45E-06	2.04E-07	0.00E+00	3.8E-07	0.0008	
Benzo(g,h,l)perylene	4.89E-07		2.05E-06	1.71E-07	0.00E+00	3.2E-07	0.0006	
Total PAH	1.68E-04	1.41E-04	7.06E-04	5.88E-05	1.14E-04	1.3E-04	0.25	2
					Maximum Individual HAP	**3.15E-03**		
					Total HAPs	**5.91E-03**		

Notes:
(1) U.S. EPA AP-42 Emission Factor Guidance Document, Section 3.3 (Diesel Industrial Engines), Table 3.3-2.
(2) U.S. EPA AP-42 Emission Factor Guidance Document, Section 3.2 (Natural Gas Fired Recipcrocating Engines).

Conversion Factors

Power	0.7457	kW/hp
Mass	2000	lb/ton

Higher Heating Value	140,000	Btu/Gal
Assumed Heat Rate	7,000	Btu/hp-hr (per AP-42 Sections 3.3 & 3.4)
Density of Oil	7.1	lb/gal

Table B-6
Garden State Offshore Energy SeaZephIR™ Spar Buoy
PM Emissions from Construction & Operation
Comparison to NJAC 7:27 Subchapter 4 - PM Emission Limits

MMBtu/hr	PM (lb/hr)
1	0.6
10	6
20	8

Equipment Make/Model[1]	Maximum Rated Power		Heat Input	Subchapter 4 PM limit (lb/hr)	Operating Hours	Proposed PM (lb/hr)
	hp	kW	MMBtu/hr			
Installation Equipment:						
Caterpillar 3412	800	597	5.60	3.36	80	1.76
Kubota SR613X	50	37	0.35	NA	128	NA
Yanmar HT210A	7.5	6	0.05	NA	76	NA
Detroit Diesel 471	242	180	1.69	1.02	31	0.53
Detroit Diesel 471	242	180	1.69	1.02	30	0.08
Deutz TCD 2013	125	93	0.88	NA	12	NA
Cummins 9310	425	317	2.98	1.79	10	0.94
Yanmar 903	9	7	0.06	NA	20	NA
Lister 3475	34	25	0.24	NA	20	NA
John Deere PR2-8	150	112	1.05	0.63	15	0.33
Briggs & Stratton 1550	18	13	0.13	NA	18	NA
Honda 4 stroke	150	112	1.05	0.63	24	0.07
Operation & Maintenance Equipment:						
Caterpillar 3408	600	447	4.20	2.52	24 hrs/month	1.32
Kubota D1703BG	50	37	0.35	NA	24 hrs/month	NA
Suzuki Outboard DF115	115	86	0.81	NA	24 hrs/month	NA

Note:
Subchapter 4 not applicable to units < 1 MMBtu/hr.